Adaptive Newton Methods and Goal-Oriented Error Estimation for Nonlinear Problems
Bernhard Endtmayer

In many applications in physics, nonlinear partial differential equations have to be solved. Computing this solution analytically is not possible in general and therefore we have to approximate the solution using numerical methods like the finite element method. However one is not always interested in the whole solution, but just in specific functional evaluations, like a point evaluation or a flux evaluation. For these "goals" we introduce an error estimator which provides information about the error, and we try to recover additional information, which is used to adapt the method.

Reconstruction of algebraic surfaces from their apparent contour
Matteo Gallet

In a joint work with Niels Lubbes, Josef Schicho and Jan Vrsekwe provide algorithms for reconstructing surfaces in three dimensional space from their apparent contour, namely the discriminant of the equation of the surface; I will focus on the case of smooth surfaces and present the algorithm and its conjectural generalization.

Various ways of Learning and More
Simon Hubmer

In this talk, we take a look at different ways to "learn" from examples. In particular, we consider the problem of approximating a function from sparse data, i.e., the problem of regression. Since many of the current "hot topics" like Regularization Networks, Support Vector Machines, Machine Learning and others turn out to in essence to treat exactly this same problem, we compare their varying approaches and try to bring them into a common framework.

Computing with DD-finite functions
Antonio Jiménez-Pastor

After giving a notion for DD-finite functions and, more generally, differentially definable functions, we tackle the problem of how to compute precisely with these functions. We will discuss the structure we use to represent these functions in the computer and also the algorithms and implementations for the closure properties of these functions. In particular, we will remark on the main issues we found while implementing addition and multiplication.

Nonstandard Methods for Fluid Simulations
Daniel Jodlbauer

Computational fluid problems pose a great challenge to standard methods like FEM / IgA. An increasingly popular alternative for the simulation of fluids are the so-called Lattice Boltzmann Methods (LBM). Unlike FEM, which attempt to discretize and solve a given PDE at the macroscopic level, LBM is motivated by the interaction of fluid particles at a microscopic scale. Originally, it emerged from the Lattice Gas Automaton – a cellular automaton used to simulate gas dynamics in a similar way to Conway's Game of Life. One of the biggest advantages of LBM over classical methods is its inherent parallel structure, allowing large-scale parallel computations on complicated domains. In this talk, we will present a short derivation, implementation and numerical results for the LBM scheme.

On the size of rational functions of four variables and Cartesian product
Mehdi Makhul

We provide a lower bound for the cardinality of the set of values of a certain rational function of four variables, which takes values on Cartesian products. The essential ingredient used to prove our result is a corollary of the Szemerédi–Trotter theorem about the number of lines in the plane containing at least a fixed number of points from a given finite set.

Extrapolation in variable reproducing kernel Hilbert spaces
Markus Pöttinger

Introduction to Space-Time Methods for Parabolic Problems
Andreas Schafelner

In this talk, we give an introduction to the (numerical) solution of parabolic initial-boundary value problems, which are governed by parabolic partial differential equations (PDEs). Such problems typically arise in the simulation of heat conduction problems, diffusion problems, but also for two-dimensional eddy current problems in electromagnetics. The standard approaches for solving parabolic PDEs usually treat time different than the spatial variables. However, a more recent and alternative approach consists in treating time just as another space variable, i.e., we solve a problem with one dimension more. We will present the possible advantages of such a space-time method, as well as the challenges we might have to overcome. Moreover, we will show some numerical experiments for a particular space-time finite element method.

How to construct a spline basis on multi patch domains
Agnes Seiler

Tensor product B-splines are a convenient way to define bivariate B-spline mappings and to parameterize surfaces. Often, one spline patch is not sufficient to describe a complicated shape, but such a domain is rather composed of several surface patches. In this case, the spline basis which is used to set up the parameterization consists of basis functions defined an all single patches. This talk addresses the following questions: How can basis functions across the interfaces be coupled in order to result in smooth functions? What kinds of continuity are taken into account for the coupling? Which properties should such a basis have and why? On the basis of these questions we will present a short overview of recently constructed spline bases on multi patch domains and finally have a glance at the construction of the space of approximately G^1 smooth functions.

The Ramanujan–Kolberg Algorithm and Some New Partition Identities
Nicolas Smoot

Over the past few months with the DK Seminar, I have discussed the theory of integer partitions: we have talked about some of the most fundamental approaches to studying partitions, the explicit formula for p(n), its divisibility properties, and the application of modular functions to the subject. In this talk, I finally want to give an outline of some of my own work in this area. With the supervision of Professor Paule and Dr. Silviu Radu, I have implemented an algorithm to compute partition identities of a class associated with Ramanujan and Kolberg. We will examine some motivating examples of Ramanujan–Kolberg (RK) identities, discuss the means by which such identities can be found, and then give several new examples that we have recently computed. As an interesting application, we will also demonstrate some new divisibility properties—this time for certain restricted classes of partitions–that we have discovered with the help of the RK algorithm.